

HYDROLOGICAL PROCEDURE NO. 7

HYDROLOGICAL STATION REGISTER



JABATAN PENGAIRAN DAN SALIRAN
KEMENTERIAN PERTANIAN MALAYSIA

HYDROLOGICAL STATION REGISTERS

HYDROLOGICAL STATION REGISTERS

Price: \$5

KEMENTERIAN PERTANIAN DAN PERIKANAN
MALAYSIA

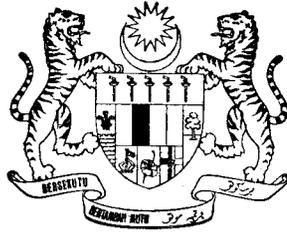
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1974



HYDROLOGICAL STATION REGISTERS

Contributor: V. M. FREESTONE
Drainage and Irrigation Division

1974
MINISTRY OF AGRICULTURE AND FISHERIES
MALAYSIA

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HYDROLOGICAL STATION REGISTERS

1. INTRODUCTION

1.1 The purpose of this procedure is to indicate the role of station registers (historical files) and to explain in detail the entries required for the following newly introduced registers:

Rainfall Station Register (J.P.T. No. 11D).

Rainfall Station Exposure Diagram (J.P.T. No. 11E).

River Station Register (J.P.T. No. 11F).

1.2 Although this procedure deals only with rainfall and river station registers, and the rainfall station exposure diagram, it is intended that there will be a station register for *every Hydrological Station*. (i.e., including evaporation stations and other hydrological stations).

1.3 Station registers are to form a comprehensive record of all relevant information pertaining to the station from the time of "establishment" to the time of "closure". This is to be a *permanent historic record* and *must be accurate and up-to-date at all times*.

1.4 The information contained on station registers will be used in the following ways:

- it will assist the processing and analysis of data,
- it is required for updating the inventory of stations,
- it will give some indication of the quality of the station,
- it is an important reference for all other aspects of hydrological operations.

1.5 All station registers are printed on "card". This will enable filing "on edge" in a steel cabinet, which will facilitate systematic filing and access of information.

1.6 Station register cards are available from the Government Printer.

1.7 *All entries are to be in metric units.*

1.8 *All information is to be checked and verified before being entered on the station register; entries must be legible, accurate, and well presented in black ink, unless requested otherwise. (i.e., certain entries are to be in pencil until verified).*

1.9 When there is no longer any space remaining on the register card to record additional information, another card is to be used and attached to the original.

1.10 A copy of every station register is to be filed in the State D.I.D. Office and in D.I.D. Headquarters Kuala Lumpur. The State D.I.D. Office will be responsible for supplying D.I.D. Headquarters with completed registers for *all existing stations and any new station established in the future*. The State D.I.D. Office will be required to furnish D.I.D. Headquarters with *all information related to changes or additions* to the registers. This information *must be supplied on a monthly basis* and will enable the registers in D.I.D. Headquarters to be kept up-to-date.

2. RAINFALL STATION REGISTER

2.1 A rainfall station register is to be completed for every rainfall station within each State. This includes both manual and recording stations in the Primary and Secondary networks.

The following is a comprehensive listing and description of entries to be made on the Rainfall Station Register (J.P.T. No. 11D). In addition two worked examples are attached and are to be studied carefully to ensure that all entries are clearly understood.

2.2 Name of station

This refers to the name of the rainfall station. Avoid duplication of names when naming new stations. The name should be meaningful; permanent landmarks and prominent features located in the vicinity of the station make good station names.

2.3 Station No.

Enter the station numbers which have been allocated by D.I.D. Headquarters.

2.4 Map reference

The latest one mile to one inch maps are to be used for extracting the following information:

Series No.	...	} To be copied from the map.
Sheet No.	...	
Edition	...	

Grid Reference: Before taking this, it is imperative that the location of the station has been accurately established on the map. Compass bearings are to be taken to enable determination of the exact locations of the station where necessary.

A six digit grid reference is to be taken. The first 3 numerals are taken in a "left to right" direction and the last 3 numerals are taken in the "bottom to top" direction. The six digit grid reference is to be qualified by the "square identification" as a prefix; i.e., WL 262821.

2.5 Longitude

Lines of longitude indicate the location “East of Greenwich” and these are shown as vertical lines in a left to right direction. The longitude is to be estimated to the nearest “5 seconds of a degree” and must be qualified by the letter “E” (i.e., 102° 30’ 15”E).

2.6 Latitude

Lines of latitude indicate the location either North or South of the equator. (Malaysia being located in the Northern Hemisphere has only northerly latitudes). These are shown as horizontal lines in a “bottom to top” direction. The latitude is to be estimated on the nearest “5 seconds of a degree” and must be qualified by the letter “N”. (i.e., 21° 29’ 05”N).

A template should be made to facilitate the extraction of longitude and latitude.

2.7 Altitude

This is the height of the station (ground level) above mean sea level datum (M.S.L.). Where convenient this is to be taken to the nearest 1 metre. But where this is not possible the altitude is to be extracted from standard topographical maps and qualified by “*topo*” in brackets after the entry.

2.8 Aspect

The aspect defines the direction towards which the gauge is most exposed; the compass direction normal to the slope contour of the local *valley side* on which the gauge is located should be entered as one of the following: N, NE, E, SE, S, SW, W, NW.

If the gauge is located on a flat plane or plateau, or if for other reasons the aspect is ill-defined; then enter the words “ill-defined”.

If uncertain of the aspect do not make an entry.

2.9 Classification of stations

The classification of rainfall stations into Primary or Secondary networks will be made by D.I.D. Headquarters. Enter either “Primary” or “Secondary”, whichever applies.

2.10 Purpose of station

Only to be completed by D.I.D. Headquarters, if required.

2.11 Exposure

Only a general statement is required for this entry as there is a special form (J.P.T. 11E) for presenting the exposure details. (See paragraph 3).

The exposure of the rainfall station relates to the immediate vicinity of the gauge.

Enter details of the following :

- the presence of buildings or other permanent features,
- the presence of trees, shrubs etc.,
- the general ground slopes in the vicinity of the station (i.e. angle from horizontal),
- if the exposure of the gauge is not representative of the surrounding area, then enter “over-exposed” where the gauge is situated on an exposed hill top, or “under-exposed” where the gauge is situated in an extremely sheltered location.

The following are examples of the type of entries required :

- Buildings and trees in vicinity of station (greatest angle from horizontal is 40°); 20° ground slope; sheltered by buildings on northerly side.
- The greatest angle between the horizontal and buildings, objects, trees is less than 5°; flat ground; exposure typical.
- Trees in vicinity of station; sited on an over-exposed ridge in hilly-rugged terrain.

2.12 Controlling Authority

This refers to the name of the Authority responsible for the operation of the station. In most cases this will be the D.I.D. State Office; but in some instances M.M.S., N.E.B., P.W.D., FELDA, or other Authorities may be responsible for the operation of the station.

2.13 Address

This refers to the address of the Controlling Authority.

2.14 Telephone

The telephone number of the Controlling Authority must be shown, if possible.

2.15 Observer

The table below this entry refers to the details of the observer. The observer is distinct from the controlling authority in that observer refers to the person actually operating the station (i.e. taking observations). At stations where there are manually read raingauges, evaporation pans or stick gauges, an observer has generally been appointed. Where there are one or a number of persons from an “Authority” operating the station the information required refers to the Authority. (e.g. For D.I.D. automatic recording stations, the D.I.D. will be the observer as well as the

Controlling Authority). The station may be operated by two observers; i.e. the D.I.D. may operate the recorder and an independent person may take manual observations.

Name — The name of the observer.

Address — The address of the observer.

Telephone — The telephone number of the observer.

Period: *From* — the date on which the observer began his duties.

To — the date on which the observer terminated his duties.

2.16 Hydrological region

This is the name of the hydrological region in which the rainfall station is located. This information is to be extracted from the map showing hydrological regions of Peninsular Malaysia. Until this map is made available no entry should be made.

2.17 River system

This refers to the *name of the river system in which the rainfall station is located*. The river system is defined as being the name of the river flowing into the sea.

For example, a rainfall station is located in the Sg. Batu catchment and this is a tributary to the Sg. Klang; the Sg. Klang is the river flowing into the sea and is therefore the river system in which the rainfall station is located—thus in this case “Sg. Klang” would be entered in the space provided.

2.18 River basin

This refers to the *name of the river basin (catchment) in which the rainfall station is actually situated*. Use only river names which are shown on the topographical map series.

2.19 Name of river station

This refers to the *most upstream river gauging station (stage/discharge) which includes the rainfall station in the area represented by it*. To be extracted from the River Station Register.

2.20 Station No.

This refers to the previous entry and is to be extracted from the river station register.

2.21 Map reference

This refers to the river gauging station.

Series No.

Sheet No.

Edition

Grid Reference

} To be extracted from the River Station Register.

- 2.22 **Longitude** } These entries refer to the river gauging station mentioned
 2.23 **Latitude** } above and are to be extracted from the River Station
 Register.

2.24 **Catchment area**

This refers to the catchment area above the river gauging station and is to be extracted from the River Station Register.

2.25 **Instrumentation**

2.25.1 The table below this entry refers to the instruments and equipment located at the rainfall station.

2.25.2 *Date*: Installation—the date of installation of a particular type of raingauge.

Removal—the date on which a particular type of raingauge is removed from the station.

2.25.3 *Type of gauge*: This refers to the standard name and/or the manufacturer's name given to the gauge/recorder. This will include the model where applicable. The following are some types of gauges—standard manual, storage manual, Kent, Casella, Japanese and Capricorder 1599.

(NOTE: Do not qualify the "Type" by putting the "diameter", "capacity" or any other information which will be noted in following columns).

2.25.4 *Type of sensor*: This refers to the way in which the rainfall is collected and measured.

Some common rainfall sensors are as follows:

Type of Gauge/Recorder					Sensor
Standard manual	...	...	...	...	Collecting Can
Storage manual	...	...	...	...	Collecting Can
Kent	...	...	...	...	Natural siphon Tilting siphon
Casella	...	...	...	...	Natural siphon
Japanese	...	...	...	...	Tipping bucket
Capricorder 1599 (digital event)	...	...	...	...	Tipping bucket

Note the sensors for other types of recorders in a similar way.

2.25.5 *Limiting duration*. Clock/tape/chart: This entry applies to rainfall recorders only. Recorders are restricted by the operating time of the clock or the operating time it takes to travel the length or width of the tape/chart (where applicable, this is to be taken for only one revolution of the drum). The limiting duration for each recorder then is the *shortest of these time periods*. For strip chart/tape recorders, it is normally the operating duration of the clock; and for "piece chart" recorders it is normally the time

2.25.10 *Windshield*: Diameter — top } Internal diameter to the
 — bottom } nearest 1 cm.

Vertical height—The distance between the top rim and the bottom of the windshield to the nearest 1 cm.

2.25.11 *Volumetric measure or dipstick*: This applies to manually read raingauges only.

Enter either “volumetric measure” (v.m.) or “dipstick” (d.s.). Where a v.m. is used, state the graduated capacity of the measure. The standard “British” measure for an 8 inch raingauge has a capacity of $\frac{1}{2}$ an inch or 12.7 mm, and the standard “Metric” measure for the same gauge has a capacity of 50 mm.

2.25.12 *Time increment*: This applies to automatic rainfall recorders.

For graphical recorders this is the *distance of chart travel representing 1 day* and is to be recorded to the nearest 0.5 mm (i.e. 30.5 mm per day).

For digital event recorders; where the recording is made at irregular time intervals and the time itself is recorded, the entry required is the value of time represented by 1 digit and is to be made in the following way: 6 minutes per digit. Where the time increment for a particular recorder has changed over a period of time, the entry is to be made in accordance with the following examples:

- variable/now 30.5 mm per day,
- variable/now 6 min. per digit.

The time increment for some existing rainfall recorders is as follows:

Recorder	Time Increment
Kent daily	397 mm per day
Kent weekly	56.5 mm per day
Kent monthly	151 mm per day
Casella daily	263 mm per day
Casella weekly	37 mm per day
Japanese daily	289 mm per day
Japanese weekly	43.5 mm per day
Capricorder 1599 (digital event)	
— 2 min. time cam	2 min. per digit
— 6 min. time cam	6 min. per digit

For recorders not listed above, the time increment should be derived in accordance with the description given.

2.25.13 *Rainfall increment*: This applies to automatic rainfall recorders only.

For graphical recorders this is to be expressed as a *ratio* of the unit distance of chart travel to the value of rainfall represented by this distance, i.e.

$$= \frac{\text{unit distance of chart travel}}{\text{rainfall representing this distance}}$$

When deriving this ratio, it is essential that the same units are used for both values.

Example: a chart travel of 100 mm represents 200 mm of rainfall.

Therefore the rainfall increment is equal to the ratio of $\frac{100}{200}$ and is to be expressed in the following way: 1 : 2.

For digital event recorders the rainfall increment is the amount of rainfall required to activate the recorder. (i.e. the amount of rainfall representing one “tip of the bucket”).

Where the rainfall increment has changed over a period of time for a particular recorder, the entry is to be made in accordance with the following examples:

- variable/now 1 : 2,
- variable/now 0.5 mm.

The rainfall increment for some existing rainfall recorders is as follows:

Recorder	Rainfall increment
Kent daily	1 : 0.500
Kent weekly	” ”
Kent monthly	” ”
Casella daily	1 : 0.416
Casella weekly	” ”
Japanese daily	
— 0.5 mm tipping bucket	1 : 0.485
— 1.0 mm tipping bucket	1 : 0.970
Japanese weekly	
— 0.5 mm tipping bucket	1 : 0.485
— 1.0 mm tipping bucket	1 : 0.970
Capricorder 1599 (digital event)	
— 0.5 mm tipping bucket	0.5 mm
— 1.0 mm tipping bucket	1.0 mm

For recorders not listed above, the rainfall increment should be derived in accordance with the description given.

2.26 Location Map

A photo copy or similar type of copy is to be taken from a topographical map and glued to the space provided. This must be a clear copy and the scale should be such that it will locate the station in relation to towns, roads or any other prominent features (normally one mile to one inch, or four miles to one inch map series should be used). Indicate the scale of the map used below the edge of the glued photo copy. i.e., Scale: one mile to one inch. The station is to be marked clearly with a cross, and alongside the cross note the station number. Show the "North" point.

2.27 Access details

This entry is to include an accurate description of the most convenient means of access to the station. Details of alternative access must also be noted.

The description must begin from the State DID Office controlling the station and should include the following:

Names of towns and roads; mileage of towns and road turnoffs; note whether road turnoffs are "left" or "right". Use permanent land marks and other prominent features to assist the description where necessary. The description must be such that an officer can drive directly to the station without previous knowledge of its location.

2.28 Remarks

This space is provided for recording any pertinent information which is not recorded elsewhere on the register. Use abbreviations and do not use up all the space provided as more details may be added in the future.

3 RAINFALL STATION EXPOSURE DIAGRAM

3.1 A rainfall station exposure diagram is to be completed for every rainfall station within each state. This includes both manual and recording stations in the Primary and Secondary Rainfall Station Networks.

Additional rainfall station exposure diagrams are to be taken on the establishment of all new stations, and immediately after a change in the exposure at a station has been noted.

All rainfall station exposure diagrams are to be attached to the respective rainfall station registers.

SPECIMEN COPY ONLY

(J.P.T. 11b)

**JABATAN PARIT DAN TALIAIR
(CAWANGAN HAIDEROLOJI)
DAFTAR STESYEN HUJAN**

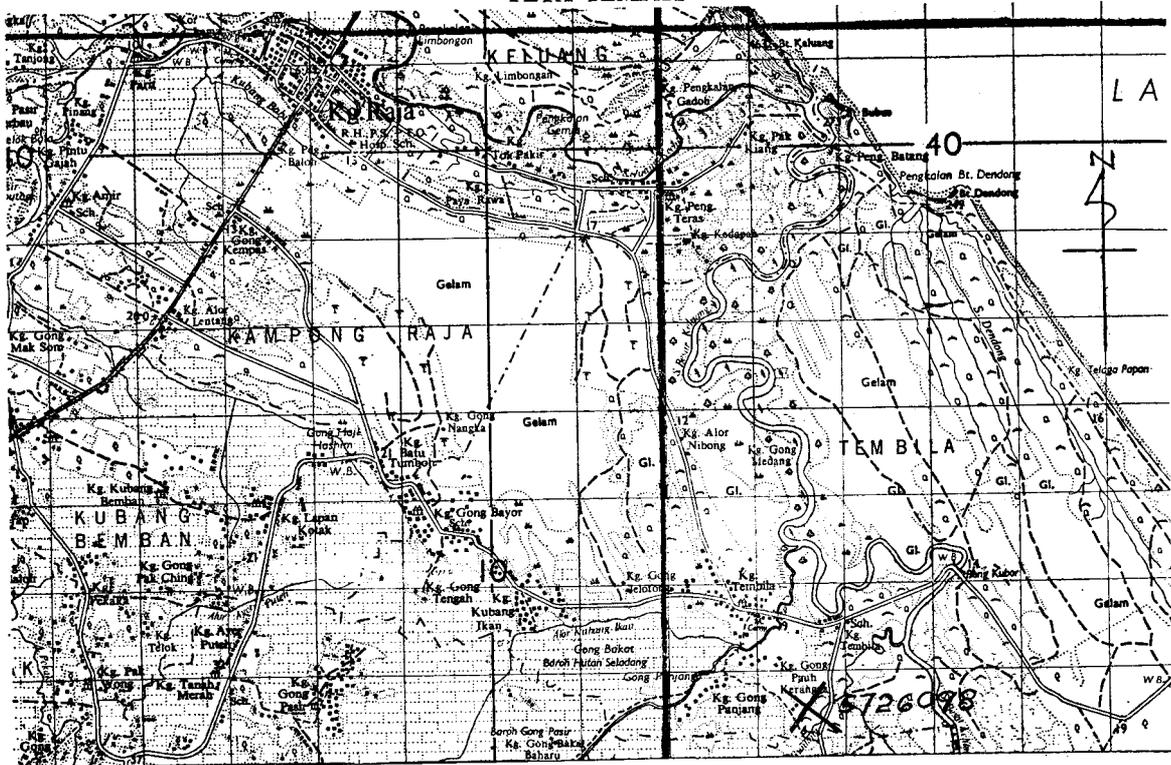
Nama stesyen Kg. Gong Panjang No. stesyen 5726098
 Rujukan peta—Siri L 7010 No. kepingan 24 Cetakan 2-DNMM Rujukan gerid RQ 136335
 Garisan bujur 102° 36' 50" E Garisan lintang 5° 43' 40" N Tinjau 108 Metres A.L.
 Aspek ill-defined Penjenisan stesyen Primary
 Tujuan stesyen _____
 Kelegaan Trees in the vicinity of station, greatest angle between horizontal and trees in less than 5°; flat ground, exposure typical of surrounding area.
 Penguasa kawalan D. I. D. Alamat D. I. D. K. Trengganu. Talipon 194 K. Tr.
 Pencatit: _____

Nama	Alamat	Talipon	TEMPOH	
			Daripada	Hingga
<u>Salleh Bol (Std. Manual)</u>	<u>Sekolah Kebangsaan.</u>	<u>129 K. Tr.</u>	<u>3-9-69</u>	
<u>D. I. D. (Auto Gauge)</u>	<u>D. I. D. K. Trengganu.</u>	<u>194 K. Tr.</u>	<u>15-1-71</u>	

Kawasan haideroloji _____ Sistem sungai Besar Keluang
 Lembah sungai Guntong Nama stesyen sungai Kerangga No. stesyen 5623489
 Rujukan peta—Siri L 7010 No. kepingan 24 Cetakan 2-DNMM Rujukan gerid RQ 139337
 Garisan bujur 102° 37' 00" E Garisan lintang 5° 43' 50" N Luas kawasan tadahan 2,350 km. per.
 Alat-alat: _____

TARIKH		Jenis tolok hujan	Jenis Penderia	Had tempoh jam/pita carta	Ulangan catitan	Muatan tolok	MULUT LUBANG TOLOK		Tolok condong/pugak	ADANGANGIN			Ukuran cara isipadu atau ukur celup	Kadar naik masa	Kadar-naik lebat-hujan
Pemasangan	Peralihan						Garis-pusat	Tinggi atas tanah		GARIS PUSAT		Tinggi pugak			
										Atas	Bawah				
<u>3-9-69</u>		<u>Std. Manual</u>	<u>Collecting Can</u>		<u>Daily</u>	<u>250mm</u>	<u>203mm</u>	<u>1.35m</u>	<u>Vertical</u>	<u>0.60m</u>	<u>0.35m</u>	<u>0.32m</u>	<u>v.m./12.7m</u>		
<u>15-1-71</u>	<u>10-9-71</u>	<u>Kent</u>	<u>Natural Siphon</u>	<u>7 days</u>			<u>127mm.</u>	<u>1.30m.</u>	<u>Vertical</u>	<u>0.65m</u>	<u>0.31m</u>	<u>0.32m</u>		<u>56.5mm/day</u>	<u>1: 0.50</u>
<u>10-9-71</u>	<u>6-6-72</u>	<u>Kent</u>	<u>Natural Siphon</u>	<u>1 day</u>			<u>127mm.</u>	<u>1.30m.</u>	<u>Vertical</u>	<u>0.65m.</u>	<u>0.31m.</u>	<u>0.32m.</u>		<u>39.7mm/day</u>	<u>1: 0.50</u>
<u>6-6-72</u>		<u>Capricorder 1599</u>	<u>Tipping Bucket</u>	<u>20 weeks</u>			<u>200mm.</u>	<u>1.32m.</u>	<u>Vertical</u>	<u>0.25m.</u>	<u>0.25m.</u>	<u>0.38m.</u>		<u>6mm/digit</u>	<u>1 mm.</u>

PETA TEMPAT



Scale: 1 inch to 1 mile

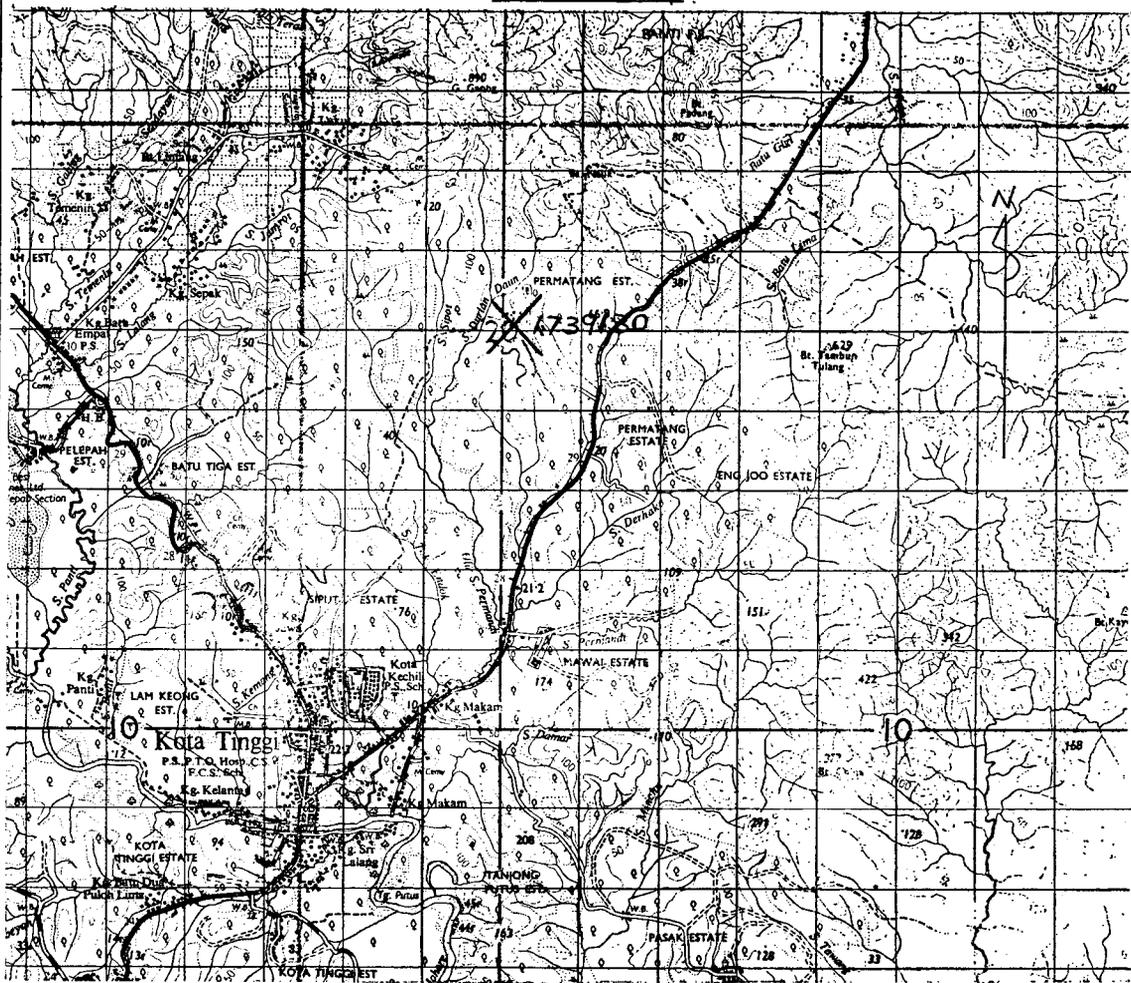
(Surihan dari peta: 1 batu seinci; 4 batu seinci; lain-lain sekil yang sesuai.)

Butir-butir masuk-laluan From D.I.D office K.Trengganu take the main north road (K.Trengganu-Kota Bharu) to Jerteh. At Jerteh turn right to take the Kg. Raja road. At Kg. Raja Town go down the hospital road for approximately 12.5 km. to Kg. Tembila. Continue on this road for another 1.5 km. (approx.) until arriving at Kg. Tembila school; take the road to the right immediately before the school and travel down the road for about 1.5 km. The station is located in the right and is visible from the road. (30 metres.)

Catitan During the installation of the Capricorder 1599 on G-6-72 the complete rainfall station was moved 55m. SSE. from the former position. The Tipping Bucket sensor was mounted on a 10cm. I.D. G.I. pipe, while the capricorder itself was located in the gate keeper's house - the Tipping Bucket & Capricorder being connected by an electrical cable burried 0.3m. below the ground. The timber stand for the manual R.G. was replaced by a new stand of 10cm. I.D. G.I. pipe on the same day.

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Location Map.



Scale: 1 inch to 1 mile

(Traced from map: 1 mile to an inch; 4 mile to an inch; other suitable scale.)

Access details: - From the D.I.D office Johore Bahru proceed to Kota Tinggi, from Kota Tinggi take the Mersing Road for approximately 15 km. until the road into the Permatang Estate is located on the left, drive in for approximately 3 km, the rainfall station is in an area opposite the main administration block.

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ONLY**

Remarks: - although the tipping bucket sensor is located in the rainfall enclosure, the capricorder 1599 (installed 15-7-72) itself is located in the Manager's office inside the main Administration block - the electrical cable between the sensor and recorder is housed in a 2.5 cm. I.D., G.I. pipe and buried 0.3 m. below the ground surface.

The following is a listing and description of entries to be made on the “rainfall station exposure diagram” card (J.P.T. No. 11 E). In addition, two worked examples are attached and are to be studied carefully to ensure that all entries are clearly understood.

3.2 Name of station

Use the same name as noted on the “Rainfall Station Register”.

3.3 Station No.

Use the same rainfall station number as noted on “Rainfall Station Register”.

3.4 Date of previous exposure diagram

This refers to the date on which the last exposure diagram was taken in the field.

3.5 Date of this exposure diagram

This refers to the date on which the current exposure diagram was taken in the field.

3.6 Signature

This refers to the signature of the person who drafted the exposure diagram in the field.

3.7 Scale

The exposure diagram is a horizontal projection showing the objects surrounding the station and is to be drawn to scale. However, where it is useful to show the presence of objects which do not conveniently fit into the scale, these can be shown by drawing the objects at the outer perimeter of the diagram. The distance to the gauge should be shown alongside an arrow pointing towards the centre.

The scale should be such that objects located at a distance from the gauge of at least 5 times their height are shown in the diagram. The scale is to be in metric and is to show the effective horizontal distance per 1 cm. (i.e., 1 cm : 2 m).

3.8 Diagram

This refers to the diagram itself.

The concentric circles and lines are an aid for positioning surrounding objects in relation to the North Point and gauge.

Use the rain gauge (manual gauge) as the centre of the sketch and line this up with the North Point. Sketch the position and heights of all rain gauges, equipment, building, trees, hills and other objects within the vicinity of the gauge. The vertical

height above ground level is to be indicated either on, or near the object. Indicate ground slopes in the vicinity of the gauge site; and measure the angle of the more distant obstructions. (i.e., between the top of the gauge and the top of the obstruction).

Distances can be measured with a "tape measure" (shorter distances) or by "stepping out" (longer distances). A "clinometer" or other instrument can be used for measuring the vertical angle. The name of the object should be stated either on or near it i.e., rubber trees, house, factory, road, etc.

3.9 Photographs

These are to be glued to the space provided. Two or three photographs should be taken, showing the station and general exposure. The Station must feature in every photograph as a point of reference. Ensure the "date" and "direction" has been recorded for each photograph.

4 RIVER STATION REGISTER

4.1 A river station register is to be completed for every river station within each State. This includes both manual and recording stations in the Primary and Secondary Networks.

The following is a comprehensive listing and description of entries to be made on the River Station Register (J.P.T. No. 11F). In addition, two worked examples are attached and are to be studied carefully to ensure that all entries are clearly understood.

4.2 River

The name of the river is to be entered.

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ONLY

JABATAN PARIT DAN TALIAIR
(CAWANGAN HAIDEROLOJI)

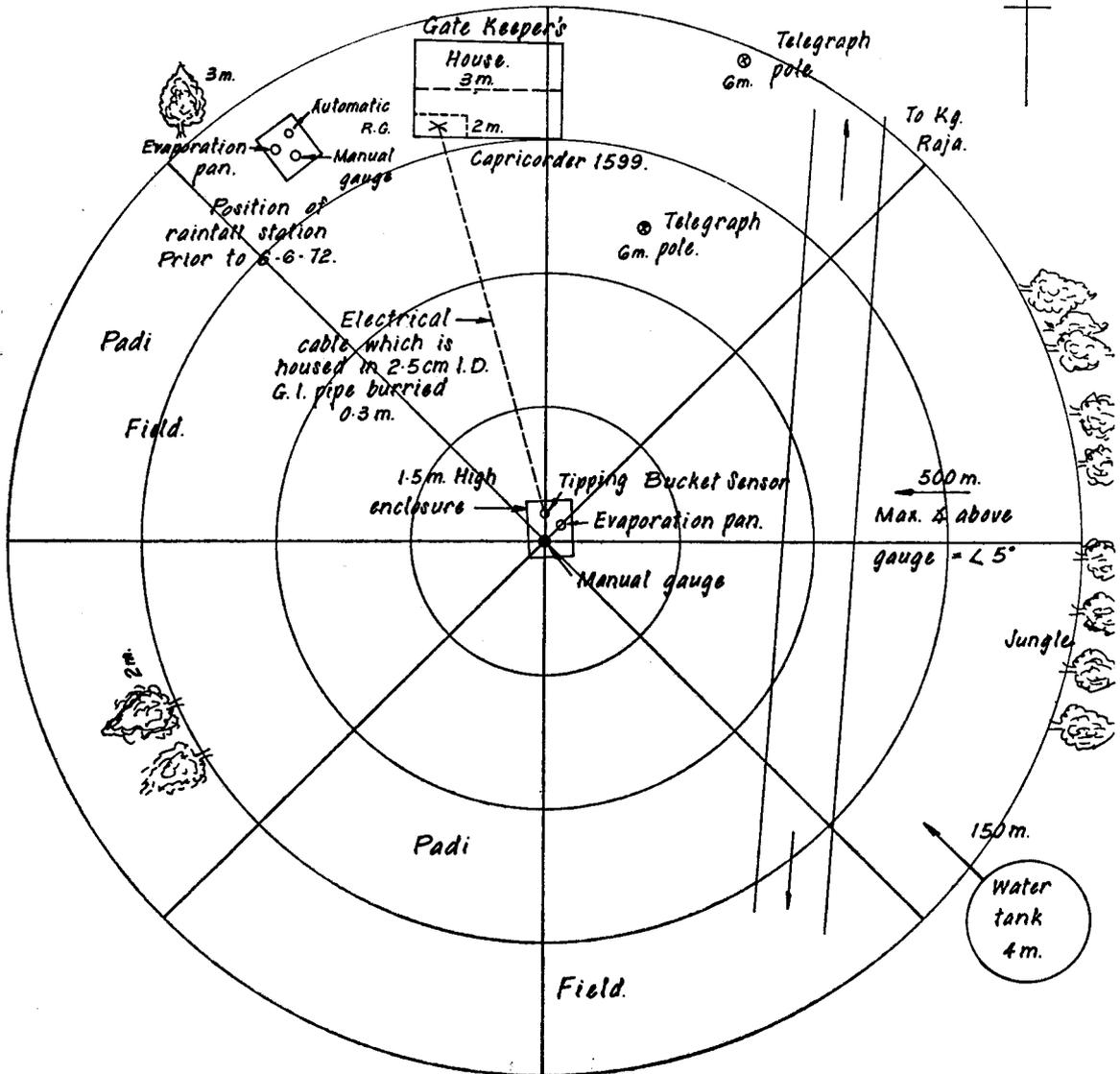
(J.P.T. 11e)

GAMBARAJAH KELEGAAN STESYEN HUJAN

Nama stesyen... Kg. Gong Panjang No. 5726098

Tarikh gambarajah kelegaan yang lepas.....

Tarikh gambarajah kelegaan ini... 6.6.72



Tandatangan... [Signature]

Sekil... 1cm. : 6m.

GAMBAFOTO

Date: 6-6-72

Direction: Looking N.E.

**SPECIMEN COPY
ONLY**

Date: 6-6-72

Direction: Looking S.W.

Date: 19-5-73

Direction: Looking S.

(Peringatan: Sila pastikan tarikh dan arah dicatitkan pada tiap-tiap gambafoto.)

Photographs



Date: 23.12.72
Direction: Looking N.E.
- General View.



**SPECIMEN COPY
ONLY**

Date: 29.1.73
Direction: Looking N.



Date: 29.1.73
Direction: Looking S.



(Note: Ensure that the date and direction has been recorded for each photograph.)

4.3 Name of station

This refers to the name of the river station. Avoid duplication of names when naming new stations. The name should be meaningful; permanent landmarks and prominent features located in the vicinity of the station make good station names.

4.4 Station No.

Enter the station numbers which have been allocated by DID Headquarters.

4.5 Map Reference

Refer to paragraph 2.4 for details.

4.6 Longitude }
4.7 Latitude } Refer to paragraphs 2.5 and 2.6 for details.

4.8 Catchment area

The total catchment area above the river station is defined by the surface topography and is represented by the horizontal projection as shown by a topographical map. The river station is defined as being the location of the permanent gauging section; where no gaugings are taken this will then be the location of the stick gauges. The latest topographical maps are to be used for extracting the catchment area, preferably the one mile to one inch series. *Extreme care must be taken when drawing the catchment boundary and planimentering the area.* The area is to be expressed in square kilometres and taken to the nearest 3 significant figures (i.e. $7391.2=7,390 \text{ km}^2$ and $12.374=12.4 \text{ km}^2$)

4.9 Hydrological region

This is the name of the hydrological region or regions which are incorporated in the catchment above the river station. This information is to be extracted from the map showing the hydrological regions of West Malaysia. Until this map is made available no entry should be made.

4.10 River system

This refers to the name of the river system on which the river station is located. The river system is defined as being the name of the river flowing into the sea. The river station may be located on this river, or a tributary, or sub-tributary to it.

For example, a river station is located on the Sg. Batu and this is a tributary to the Sg. Klang; the Sg. Klang is the river flowing into sea and is therefore the river system on which the river station is located—thus in this case “Sg. Klang” would be entered in the space provided.

4.11 **Classification of station**

The classification of river stations into Primary or Secondary Networks will be made by DID Headquarters. Enter either “Primary” or “Secondary” whichever applies.

4.12 **Purpose of station**

Only to be completed by DID Headquarters, if required.

4.13 **Controlling Authority**

Refer to paragraph 2.12 for details.

4.14 **Address**

This refers to the address of the Controlling Authority.

4.15 **Telephone**

The telephone number of the Controlling Authority must be shown, if possible.

4.16 **Observer**

Refer to paragraph 2.15 for details.

4.17 **Stick Gauges**

4.17.1 The table below this entry refers to information about stick gauges. A stick gauge is defined as being an individual length of graduated gauge. The standard metric stick gauge will be 2 metres long. At any one station there must be *sufficient stick gauges to cover the anticipated extreme range in river height*. For this reason a number of spaces are provided “down” the register. Each space in the table refers to only one individual stick gauge length and the information is entered from left to right on the card.

4.17.2 *Location:* The following information is required—

The bank on which the gauge is installed and distance upstream or downstream from recorder stilling-well intake pipe or pressure sensor (pressure bulb or exit of bubble delivery). If there is no water level recorder, the stick gauge should be related to a distance from a bridge, bench-mark, cableway or other permanent landmark.

Examples of entries to be made are:

- Left bank, 20 m upstream recorder intake,
- Right bank, 100 m downstream road bridge.

4.17.3 *Range:* This denotes the “lowest” to “highest” values which can be read off each individual stick gauge. (i.e., 5.0-7.0 m is the range of one particular 2 metre stick gauge).

4.17.4 *Established:* This refers to the time when the gauge was originally installed.

Datum of bottom—This is the R.L. or Assumed Level of the “bottom” of the graduated scale on every stick gauge. This must be levelled independently for every individual stick gauge. This is to be recorded to the nearest 0.001 metre and the value of the datum must be qualified by “R.L.” or “Assumed Datum” (i.e., Datum of bottom: 159.321 m R.L.).

Date—This refers to the date on which the datum was established.

Level Book—This refers to the number of identification of the level book in which the field survey and computations related to the “datum of bottom” have been logged.

4.17.5 *Checked:* After the initial installation and levelling, the datum of every individual stick gauge is to be checked on a regular basis. This must be *at least once a year*, but must also be done after every major flood or at *any other time when there may have been a change in datum*.

If a check on the datum reveals that there has been no change for all stick gauges a statement to this effect is to be made in the “remarks”, noting the date of the check (i.e., datum of stick gauges checked on 2/3/71—no change). This is to avoid wasting space in the “check” column. However, where there has been a change in datum, even if it is only one of the stick gauges, the information is to be listed in the checked column for all of the stick gauges.

Datum of bottom ...	} Follow the same procedure as outlined above under “established” (See paragraph 4.17.4).
Date ...	
Level book ...	

4.18 **Recorders**

4.18.1 The tablet below this entry *refers to one or a number of recorders which may have been, or may at present be installed at the station*. This tablet will not apply to stations where there is, and has been only a stick gauge.

4.18.2 *Date:* Installation—the date of installation of a particular type of recorder.

Removal — the date on which a particular type of recorder is removed from the station.

4.18.3 *Type:* The type of recorder refers to the manufacturers name and the particular model of the recorder, where applicable. The following are some types of recorders: Stevens A35, Kent, OTT type X, Negretti & Zambra, Capricorder 1598D, etc. (N.B.: Do not qualify the “type” by putting the “range” or other information which will be noted in the following columns).

4.18.4 *Serial Number:* This refers to the serial number of the recorder where given; not that of detachable components such as the recorder clock.

4.18.5 *Max. Range*: This refers to the maximum *range in stage* through which the *recorder* is capable of recording (within the marked boundaries or scale of the chart) and is to be recorded in metres to the nearest 1 mm. A 20 feet range Kent recorder would be entered as 6.096 m.

For reversible type recorders such as the “Stevens A35” and the “Ott Type X” the range through which the *recorder* is capable of recording will in fact be unlimited; however the range representing a single traverse (travel) of the chart must be noted and the entry made in the following way: unlimited/5 m.

For digital event recorders enter the number of digits (numerals) used for recording stage. (i.e., the number 22 is a 2 digit number; the number 4327 is a 4 digit number).

The conversion for some common “recorder ranges” is as follows:

British Units	Metric Units
1 ft	0.305 m
2 ft	0.610 m
5 ft	1.524 m
10 ft	3.048 m
20 ft	6.096 m
30 ft	9.144 m

4.18.6 *Type of sensor*—This refers to the type of stage sensor and will normally be one of the following: float/counterweight; pressure/bulb; pressure/bubble. If there is any other sensing system in operation this is to be noted.

4.18.7 *Limiting duration*—Clock/tape/chart: Recorders are restricted by the operating time it takes to travel the length or width of the chart/tape. (Where applicable, this is to be taken for only one revolution of the drum). The limiting duration for each recorder then, is *the shortest of these time periods*. For strip chart/tape recorders it is normally the operating duration of the clock; and for “piece chart” recorders it is normally the time represented by the chart travel. The limiting duration is to be recorded as the number of complete days if less than one month; where it is greater than one month the limiting duration is to be recorded as the number of complete weeks.

The limiting duration of some existing water level recorders is as follows:

Recorder	Limiting duration
Kent weekly	7 Days
Kent monthly	30 Days
Negretti and Zambra	7 Days
Cambridge	7 Days
Ott type X	8 Days
Stevens A 35	20 Weeks (approx.)
Capricorder 1598D (digital event) ...	20 Weeks (approx.)

For recorders not listed above the limiting duration should be derived in accordance with the description given.

4.18.8 *Zero of tape/chart*—This refers to the *gauge height* of the lower limit of the tape/chart. The zero of the tape/chart must be below the anticipated extreme low flow gauge height. This must be set *on an even value of gauge height*; to the nearest 1 metre where the recorder is in metric units. Where this is not convenient a setting to the nearest 0.5 metre would be acceptable. The *Zero setting of the tape/chart must* remain a constant setting for a particular station, unless there is justification for a change.

Where the zero of the chart has been set at different gauge heights over a period of time the entry to be made is to be in accordance with the following example :

“variable now 4 m”.

4.18.9 *Stage increment*—For graphical recorders this is to be expressed as a *ratio* of the unit distance of chart travel to the value of stage (river height) represented by this distance.

i.e. unit distance of chart travel
stage representing this distance

When deriving this ratio it is essential that the same units are used for both values.

Example—For a chart travel of 20 cm there is a range in stage of 10 metres = 1,000 cm.

Therefore the stage increment is equal to the ratio of $\frac{20}{1,000}$ and is to be expressed in the following way 1 : 50.

For digital event recorders the value of the stage increment is to be expressed as the value of stage represented by each digit (i.e. 3 mm per digit).

Where the stage increment has changed over a period of time for a particular recorder, the entry is to be made in accordance with the following examples :

- Variable/now 1 : 50,
- Variable/now 3 mm per digit.

The stage increment for some existing water level recorder is as follows :

Recorder	Stage Increment
Kent—20 ft	1 : 24
—30 ft	1 : 36
Negretti and Zambra—10 ft ...	1 : 30
—20 ft ...	1 : 60
Cambridge—6 m	1 : 56
Ott Type X—2.5 m per traverse	1 : 10
—5.0 m per traverse	1 : 20
Stevens A35—5 ft	1 : 6
—10 ft	1 : 12
—20 ft	1 : 24
Capricorder 1598 D (digital event)	3 mm per digit

For recorders not listed above, the stage increment should be derived in accordance with the description.

4.18.10 *Time Increment*—For graphical recorders this is the distance of chart travel representing 1 day and is to be recorded to the nearest 0.5 mm (i.e. 40.5 mm per day).

For digital event recorders, where the recording is made at irregular time intervals and the time value itself is recorded, the entry required is the value of time represented by 1 digit and is to be made in the following way— (6 min. per digit).

Where the time increment has *changed over a period of time for a particular recorder*, the entry is to be made in accordance with the following examples:

- variable/now 40.5 mm per day,
- variable/now 6 min. per digit.

The time increment for some existing water level recorders is as follows:

Recorder	Time Increment
Kent—weekly	68.5 mm per day
—monthly	22.5 mm per day
Negretti and Zambra—weekly	18-105 mm per day
Cambridge—weekly	20-113 mm per day
Ott Type X—weekly	48.0 mm per day
Stevens A35	61.0 mm per day
	122.0 mm per day
Capricorder 1598D (digital event)	
—2 min. time cam	2 min. per digit
—6 min. time cam	6 min. per digit

For recorders not listed above, the time increment should be derived in accordance with the description given.

4.19 **Details of installation and structure**

This refers to the recorder stilling well, pressure sensing unit and cableway installation. The following is a listing of the type of information required:

- internal diameter of recorder stilling well,
- the type of material used for the construction of the stilling well,
- the diameter of intake pipes and type of material used,
- material used for the pressure sensing line, the depth to which it is buried in a trench and details of any other protection given to the pressure line,
- length of cableway.

The following is an example of the type of entry required :

0.91 m internal diameter, concrete pipe stilling well;

2 of 5 cm diameter G.I. intake pipes; cableway 175 m long, established 2-3/1971.

4.20 Datum—invert of inlet pipe

The information required for this entry is the R.L. or assumed level of the invert of the inlet pipe, at the stilling well end of the pipe. (1), (2) and (3) are spaces provided for 3 inlet pipes. This entry is to be qualified by “R.L.” or “Assumed Level”.

4.21 Datum—invert of stilling well

This is the level at the bottom of the stilling well. This entry is to be qualified by “R.L.” or “Assumed Level”.

4.22 Datum—top of stilling well

This is the level at the top of the stilling well on the *underside* of the top cover or flooring. This entry is to be qualified by “R.L.” or “Assumed Level”.

4.23 Datum—pressure sensor

This is the level at the centre line of the pressure bulb or at the exit point in the case of a bubble gas system. This entry is to be qualified by “R.L.” or “Assumed Level”.

4.24 Remarks

Refer to paragraph 2.28 for details.

4.25 Major flood levels

Only to be completed by D.I.D. Headquarters, if required.

4.26 Extreme low flow levels

Only to be completed by D.I.D. Headquarters, if required.

4.27 Location map

Refer to paragraph 2.26 for details.

4.28 Site plan

This is to be shown in the space provided and must present in detail the location of the following: Stick gauges, recorder house, cableway, other structures, gauging sections including the location of the low flow gauging section where this is not at the normal gauging section, bench marks, bridges and other landmarks. The scale of the plan is to suit the station locality. Show the “North Point”. Measure and note the angle of the bridge or cableway if it is not at right angles to the direction of flow.

Date ... date on which the site plan was drafted.

Scale ... Scale of the site plan.

4.29 **Bench marks**

4.29.1 The tablet below this entry refers to information related to permanent bench marks.

4.29.2 *T.B.M. No.:* This is the prefix denoting all D.I.D. bench marks. Although by definition T.B.M. refers to “temporary bench mark”; in fact all bench marks used for hydrological purposes are permanent. The T.B.M. No. then, is the D.I.D. No. allocated to the bench mark.

4.29.3 *Assumed datum:* It is not always convenient or practicable to establish levels in M.S.L. in the first instance. (Some stations may even remain in Assumed Datum permanently). The Assumed Datum is normally based on convenient values such as 100 ft. or 100 m. The datum must be chosen such that no negative values will occur when levelling from the B.M.

- Datum — This is the actual level of the B.M. derived from the Assumed Datum, and is to be recorded to the nearest 0.001 m.
- Date Est. — This is the day on which the datum of the B.M. was established.
- Level Book — This refers to the number or identification of the level book in which the field surveys and associated computations have been logged.
- Origin — This refers to the number of the B.M. from which the datum has been derived. In the case of a B.M. which is itself the origin of the datum then the entry to be made is “origin”.

4.29.4 *Datum to M.S.L.:* This is where the datum is related to “mean sea level” and is commonly known as the R.L. Where possible the datum or level of bench marks is to be in R.L. Enter information in a similar manner to that described in paragraph 4.29.3.

4.30 **Description of “reach” and “control”**

The “reach” refers to the straight section or stretch of river in which the station is established. It is possible that the water level is measured in one reach and the gaugings are taken in another. The following is the type of information required in relation to the type of “reach”:

- length of the reach,
- the level to which the flow will be confined in the reach,
- details of bank overflow,
- whether or not the reach is diverging, converging, straight or otherwise,
- description of vegetation on river banks,
- description of bed material.

The “control” refers to the downstream condition of the river which affects the relationship between stage and discharge at the stage recording station. Controls may be permanent or shifting, artificial or natural, effective for part or the complete range in stage. Permanent controls may be defined by one or a combination of the following conditions:

- rock rapids extending across the river bed,
- artificial structures such as a concrete weir,
- a stable river bed for some considerable distance downstream of the stage recording station,
- bends and constrictions in the river course,
- stable river banks.

Shifting controls or a constantly changing stage-discharge relationship is generally influenced by the following:

- unstable bed,
- scouring of banks, bends and constrictions,
- backwater effects from a downstream tributary,
- tidal influence.

Describe the “reach” and the “control” on the basis of the above descriptions.

4.31 Gauging: bridge/wading/cable/boat

This refers to the way in which gaugings are taken at the river station. One or a number of these methods may be used; cross out which does not apply.

In addition, make note of the following in the space provided:

- distance between the gauging station and the stage recording station,
- distance between the low flow gauging section and the stage recording station (i.e., where this is located away from the normal gauging section),
- note should be made if the bridge or cableway is not “normal” (i.e., at right angles) to the direction of flow and the angle recorded.

4.32 Access details

Refer to paragraph 2.27 for details.

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**DRAINAGE AND IRRIGATION DEPARTMENT
(HYDROLOGY BRANCH)**

(D.I.D.IIF)

RIVER STATION REGISTER

River: Tembila Name of station: Kg. Tembila Road Bridge Station no.: 5626499
 Map reference:- series: L.2374 Sheet no.: 24 Edition: 2-DNMM Grid ref.: RQ133346
 Longitude: 102° 36' 40"E Latitude: 5° 44' 15"N Catchment area: 31.3 sq. km.
 Hydrological region: _____ River system: Besar Keluang Classification of station: Primary
 Purpose of station: _____
 Controlling authority: D. I. D. Address: D. I. D. Kuala Trengganu Telephone: 234
 Observer: _____

Name	Address	Telephone	Period	
			From	To
D. I. D.	As above			

Stick gauges:-

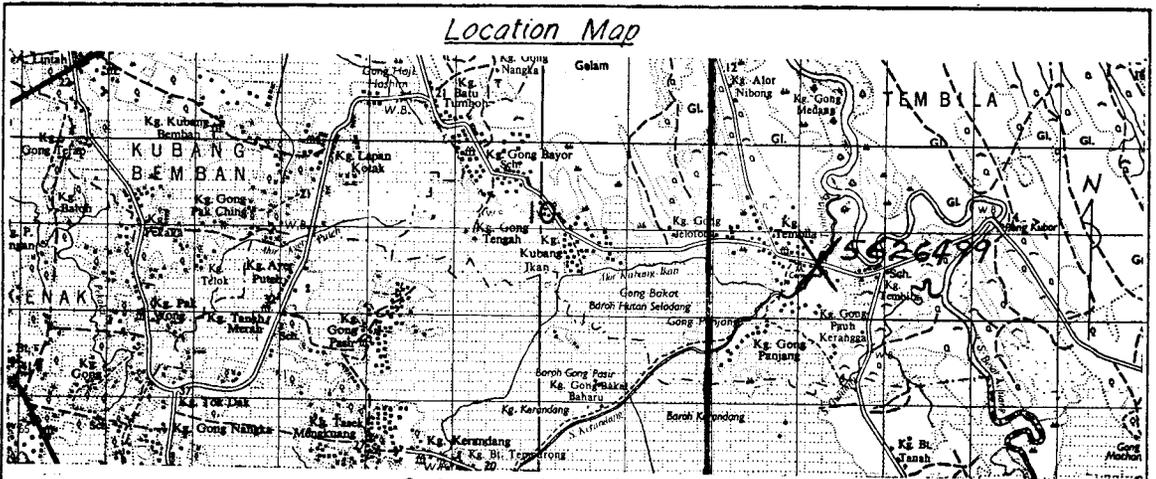
Location	Range	Established			Checked			Checked		
		Datum of bottom	Date	Level bench	Datum of bottom	Date	Level bench	Datum of bottom	Date	Level bench
L.B. 6m. $\frac{1}{8}$ Rec. Intake	101-350-103-700m.R.L.	101-350m.R.L.	2-7-71	J.P.T. R1/77	101-403m.R.L.	3-4-72	J.P.T. R3/77			
" 4m. " " "	103-700-106-050m.R.L.	103-700m.R.L.	"	"	103-712m.R.L.	"	"			
" 3m. " " "	106-050-110-235m.R.L.	106-050m.R.L.	"	"	106-050m.R.L.	"	"			
[No adjustment made - replaced by metric SG's on 6-5-72]										
L.B. 2m. $\frac{1}{8}$ Rec Intake	100-102 m.R.L.	100m.R.L.	6-5-72	J.P.T. R3/77						
" " " " "	102-104 m.R.L.	102 m.R.L.	"	"						
" " " " "	104-106 m.R.L.	104 m.R.L.	"	"						
" " " " "	106-108 m.R.L.	106 m.R.L.	"	"						
" " " " "	108-110 m.R.L.	108 m.R.L.	"	"						

Recorders:-

Date		Type	Serial number	Max. Range	Type of sensor	Limiting duration clock/ tape/ chart	Zero of scale/ chart	Stage increment	Time increment
Installation	Removal								
2-7-71	2-12-71	Steven A35	ST. 9670	Unlimited/ ± 5 m.	Float/Counterweight	20 weeks approx.	100-321 m	1:10	122 mm per day.
2-7-71		Capricorder 1598 D	A367	Unlimited/2digit	Float/Counterweight	20 weeks approx.	100-0m	3mm per digit	6 min. per digit.

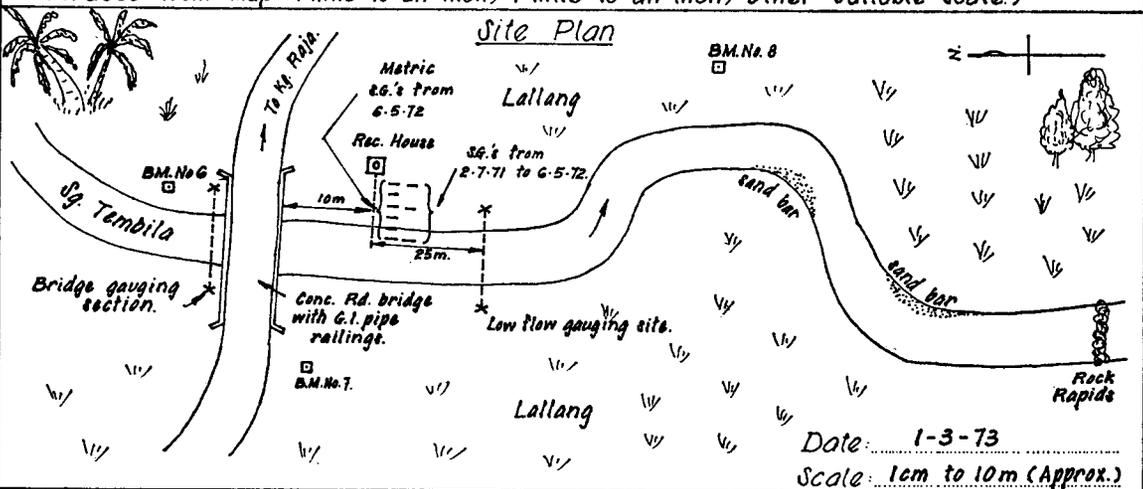
Details of installation and structure: Concrete pipe stilling well - I.D. = 0.53m. steel intake pipes - 25cm. I.D. with 5cm. I.D. static tube of G.I. pipe. Non-walk in housing.
 Datum-invert of inlet pipe: 1) 101.423 m. R.L. 2) 102.120 m. R.L. 3)
 Datum-invert of stilling well: 100.825 m. R.L.
 Datum-top of stilling well: 111.235 m. R.L.
 Datum-pressure sensor: _____
 Remarks: Datum of stickgauges checked on 3-1-72 - no change from original datum (2-7-71) New metric stickgauges operational on 6-5-72.

Major Flood Levels			Extreme Low Flow Levels		
Date	Discharge	Datum	Date	Discharge	Datum



Scale: 1 inch to 1 mile

(Traced from map: 1 mile to an inch; 4 mile to an inch; other suitable scale.)



Bench Marks:

T.B.M. No.	Assumed Datum				Datum to M.S.L.			
	Datum	Date Est.	Level Book	Origin	Datum	Date adopted	Level Book	Origin
J.P.T.B.M.No.6	100.000 m.	20.3.71.	J.P.T.R.1/77	Origin	127.345 m.	15.6.71	J.P.T.R.1/77	BM26F SURVEY DEPT.
J.P.T.B.M.No.7	99.601 m.	"	"	No. G	126.946 m.	"	"	"
J.P.T.B.M.No.8	83.742 m.	"	"	No. G	111.087 m.	"	"	"

Description of "Reach" and "Control": There is a straight reach of approximately 80m, 20m on U/s side of bridge and 55m on d/s side; despite the short approach reach on the U/s the flow is at rt. & to the bridge. The flow is confined to a level of 20m R.L. approximately. There is some minor bank erosion; lallang is covering most of both bank. Sandy bed. Permanent rock control (Low-med stage) in the form of rapids, covering full width of section - located 200m. d/s of bridge.

Gauging - Bridge / Wading / Cable / Boat: Med-high stages gauged from U/s side of bridge - 12m U/s of rec. intake; low stages gauged by wading - 25m. d/s of rec. intake.

Access Details - From D.I.D. office K. Trengganu take the main north road (K. Trengganu - Kota Bharu) to Jerteh. At Jerteh turn right to take the Kg. Raja Road. At Kg. Raja town go down the hospital Road for approximately 12.5 km. to Kg. Tembilila, continue on this road for another 1 km. (approx.) until arriving at the road bridge across the Sg. Tembilila. The recorder station is located on the L. B. approximately 10m. d/s of the bridge.

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PROCEDURES PREVIOUSLY PUBLISHED

No. 1	Estimation of the Design Rainstorm	1973
No. 2	Water Quality Sampling for Surface Water	1973
No. 3	A General Purpose Event Water—Level Recorder Capricorder Model 1598)	1973
No. 4	Magnitude and frequency of floods in Peninsular Malaysia ...	1974
No. 5	Rational method of flood estimation for rural catchments ...	1974
No. 6	Hydrological station numbering system	1974